



OFFICE OF  
**RIVER PROTECTION**  
United States Department of Energy

# WTP Pretreatment Facility Technical Issues Resolution Update

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Presented by: **Waste Treatment and Immobilization Plant**

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# Waste Treatment and Immobilization Plant







# Pretreatment Facility Function



- Tank waste is pumped to the Pretreatment (PT) Facility's interior waste feed receipt vessels
- PT separates the low-activity radioactive waste from the high-level radioactive waste
- During pretreatment, waste is concentrated by removing water in an evaporator
- Solids filtered out for inclusion in high-level waste stream; remaining soluble, highly radioactive isotopes removed with ion-exchange process







- In late 2012, the U.S. Department of Energy (DOE), Office of River Protection (ORP) limited project activities at the PT Facility
- Restrictions were imposed on the remaining engineering, procurement, and construction work due to:
  - Unresolved technical, management, and quality issues
  - Need for design and nuclear safety basis alignment





## T1 Hydrogen Gas Events in Vessels\*

- Risk of combustion in the headspace of high-solids vessels due to hydrogen accumulation
- Resolved with approval of revised hydrogen safety control strategy consisting of both preventive and mitigative safety and process controls

## T2 Criticality in Pulse-Jet Mixer (PJM) Vessels\*

- Dense fissile particles could settle on the bottom of Waste Treatment and Immobilization Plant (WTP) vessels with sufficient mass and geometry such that a criticality event is credible
- Issue resolved via calculations, engineering and chemistry studies, criticality safety evaluations, and integrated process controls

## T3 Hydrogen in Piping and Ancillary Vessels\*

- Flammable gases generated by waste treated in WTP could accumulate in process piping and cause deflagration event
- Resolved by updating WTP safety basis, basis of design, and process piping design criteria to prevent or control potential hydrogen explosions

## T4 PJM Vessel Mixing and Control

- Concern with adequacy of pulse jet mixer (PJM ) mixing and control system
- Complete testing of standard high solids vessel prototype

## T5 Erosion/Corrosion in Piping and Vessels

- Uncertainties exist in waste feed characteristics and ability to meet 40-year service life
- Confirm erosion/corrosion design basis, including margin, through testing and analysis

## T6 Design Redundancy/ In Service Inspection

- Perform failure modes, effects, and criticality analysis
- Complete conceptual design of planning areas 2, 3, and 4

## T7 Black Cell Vessel/ Equipment Structural Integrity

- Seismic ground motion criteria for WTP changed around 2005
- Complete structural analysis of standard vessel and strategy for structural upgrades to installed vessels

## T8 Facility Ventilation/Process Off-Gas Treatment

- Multiple technical challenges associated with ventilation system, including high-efficiency particulate air (HEPA) filters
- Complete engineering/nuclear safety assessments to ensure ventilation meets requirements



Resolved\*



Testing underway



Ongoing



## ➤ **Design changes**

- Standard high-solids vessel (SHSV) PJM vessel designs
- Planning areas 2, 3, and 4 conceptual design study

## ➤ **Pretreatment flowsheet changes**

- Removal of oxidative leaching process
- Reduced aluminum leaching temperature
- Removal of cesium concentration evaporator

## ➤ **Test SHSV at full scale**

## ➤ **Updated nuclear safety analysis**

- Hydrogen in vessels
- Criticality
- Hydrogen in piping and ancillary vessels

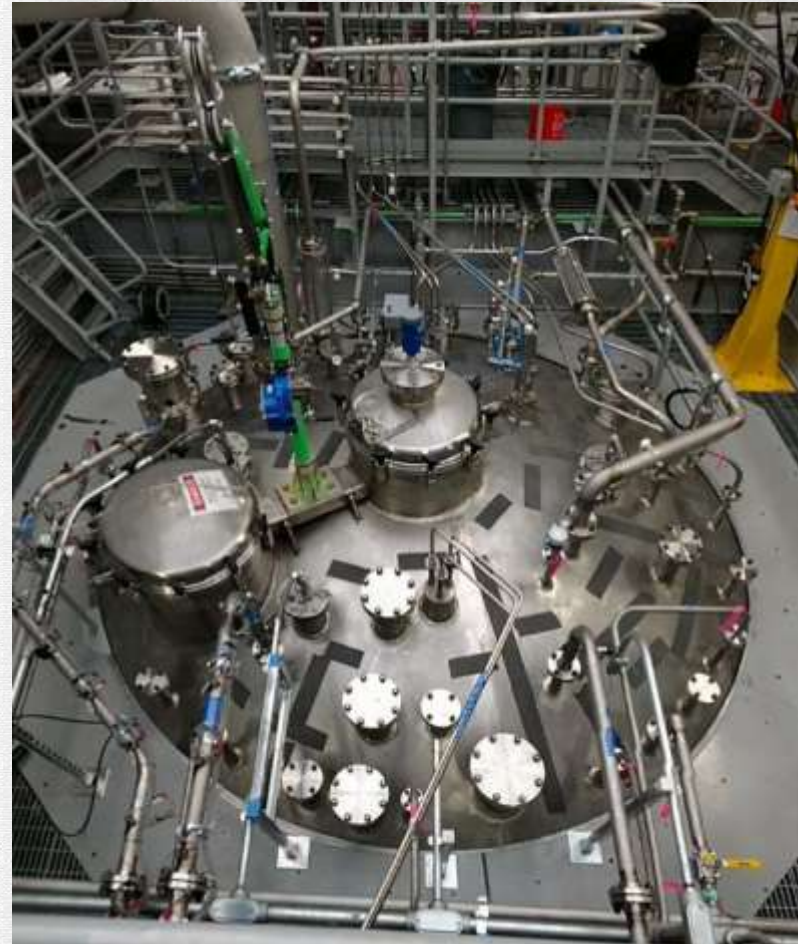






# Standard High-Solids Vessel Testing

- **PJM control testing began in December 2016**
- **Testing completion expected end of 2017**

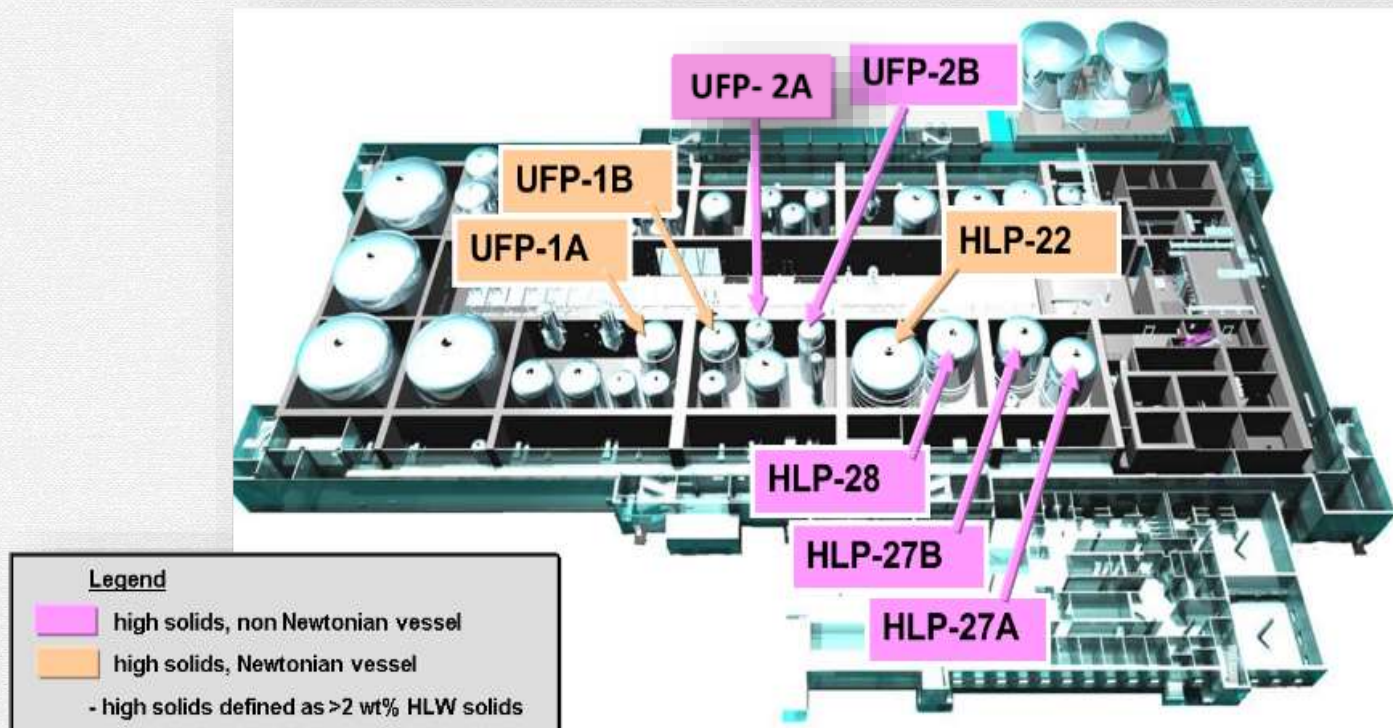


An overhead view of the 16-foot-diameter by 35-foot-tall vessel shows the platform and all test equipment installed.





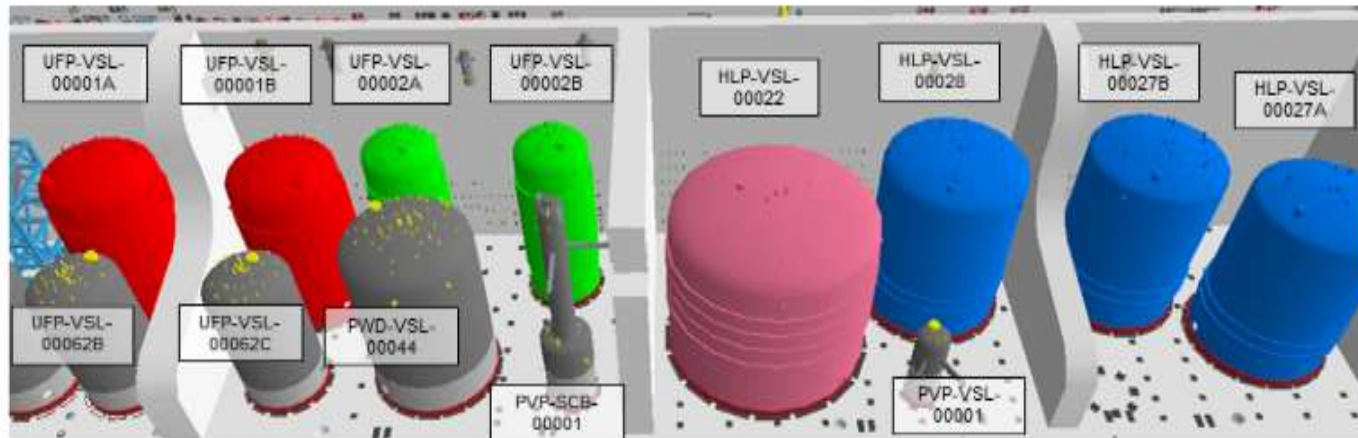
- Technical Issues Focused in Pretreatment Planning Areas 2, 3, and 4
- DOE is evaluating replacing up to eight vessels with smaller vessels; approximately 17,000 gallons, 16-foot diameter, six PJMs
- Candidate vessels to replace in design represent five designs: 30,000 - 160,000 gallons



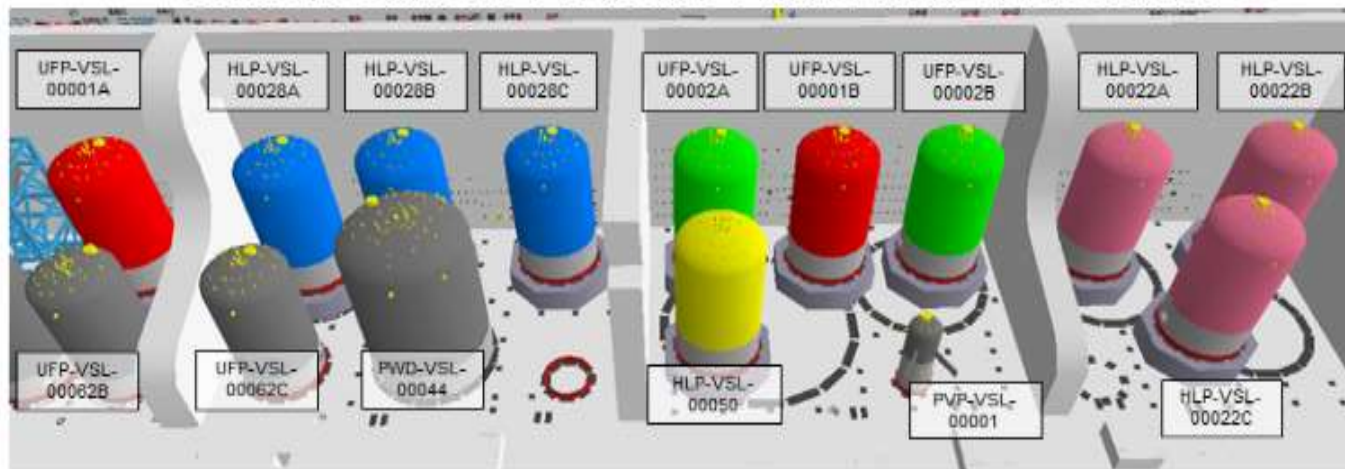




## CURRENT BLACK CELL LAYOUT FOR HIGH SOLIDS VESSELS



## DESIGN CONCEPT LAYOUT FOR BLACK CELL SHSVD



Vessel color coding depicts common functionality between current design configuration (top) and proposed design configuration with SHSV (bottom).







- **ORP striving to have all remaining technical issues resolved in 2018 and return WTP Pretreatment to design**
- **WTP Pretreatment authorization to proceed with production engineering**
- **Complete facility designs and safety basis documentation in accordance with federal regulations**







# Safety Always Comes First!

The Hanford Reach  
White Bluffs Overlooking the Columbia River

